

Proseminar Ausgewählte Themen der Künstlichen Intelligenz

Dr. habil. Julien Vitay

Proseminar KI

Organization

- Registration by julien.vitay@informatik.tu-chemnitz.de ASAP.
- Choice of a topic (title with a small abstract / structured plan) until 03.05.
- Presentation (15 + 5) at the end of June / beginning of July.
- Small report (5-10 pages, 4 weeks preparation time).

Pedagogical goals

- Learn to build autonomously a scientific-level presentation.
- Getting used to speak in public and be evaluated.
- Why not in English?

AI lab of Prof Hamker



- Head: Prof. Dr-Ing Fred Hamker

- Academic staff:

- Susan Koehler (secretary)
- Dr. Javier Baladron
- Dr. John Nassour
- Dipl.-Math. Ralph Sontag
- Dr. Michael Teichmann
- Dr. habil. Julien Vitay

- Website: <https://www.tu-chemnitz.de/informatik/KI>

- PhD Students:

- Abbas Al Ali
- Payam Atoofi
- Julia Bergelt
- Helge Ülo Dinkelbach
- Hoa Tran Duy
- Francesc Escudero
- Aida Farahani
- Lorenz Gönner
- Tobias Höppner
- René Larish
- René Richter
- Alex Schwarz

- Plus many Bachelor/Master students, interns...
- Don't hesitate to contact us for your internships, research seminars and theses.

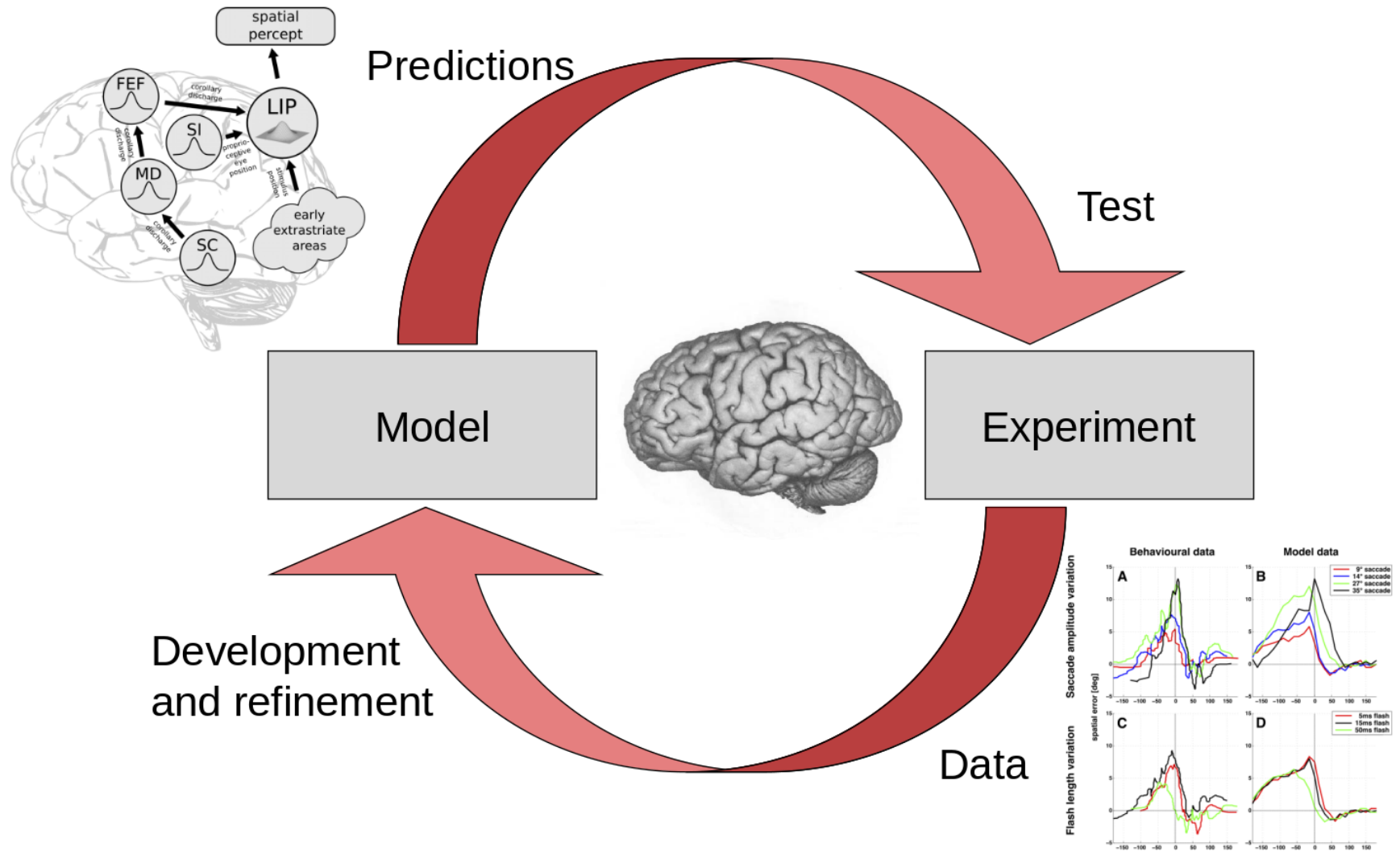
Courses offered

- **Einführung in der KI:** summer semester, Bachelor, Prof. Hamker.
 - Presents the basic concepts of AI.
- **Neurokognition I and II:** winter+summer semester, Master, Prof. Hamker.
 - Computational neuroscience, brain modeling.
- **Neurocomputing:** winter semester, Bachelor, Dr. Vitay.
 - Deep learning, reservoir computing, neural computation.
- **Deep Reinforcement Learning:** winter semester, Master, Dr. Vitay.
 - Reinforcement learning, robotic control, video games.
- **Robotik:** winter semester, Bachelor + Master, Dr. Nassour.
 - Kinematics, control, humanoid robots, social robotics.

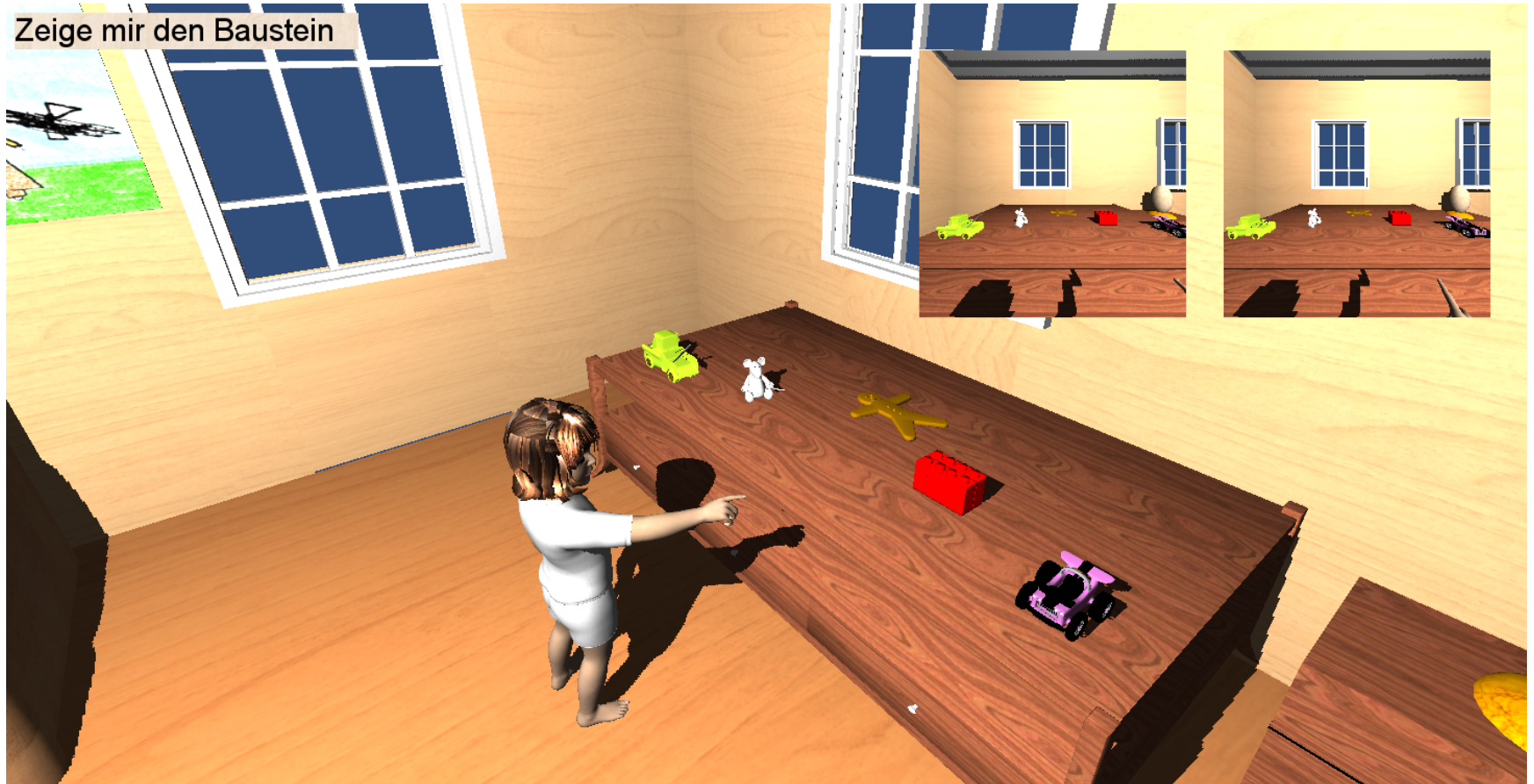
Past:

- Maschinelles Lernen: Prof. Andres (PSY).
- Bildverstehen: Jun-Prof. Kowerko (INF).

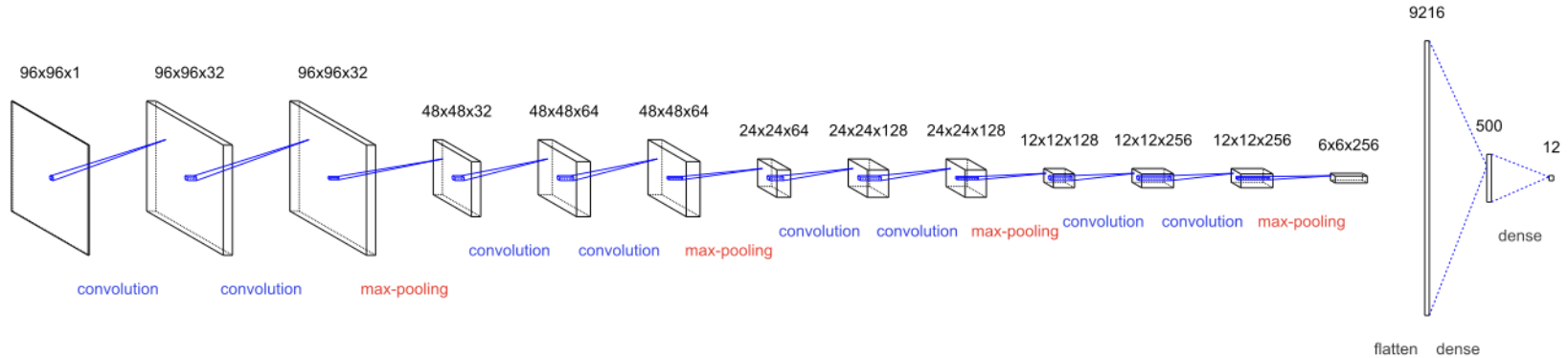
Research: Computational Neuroscience



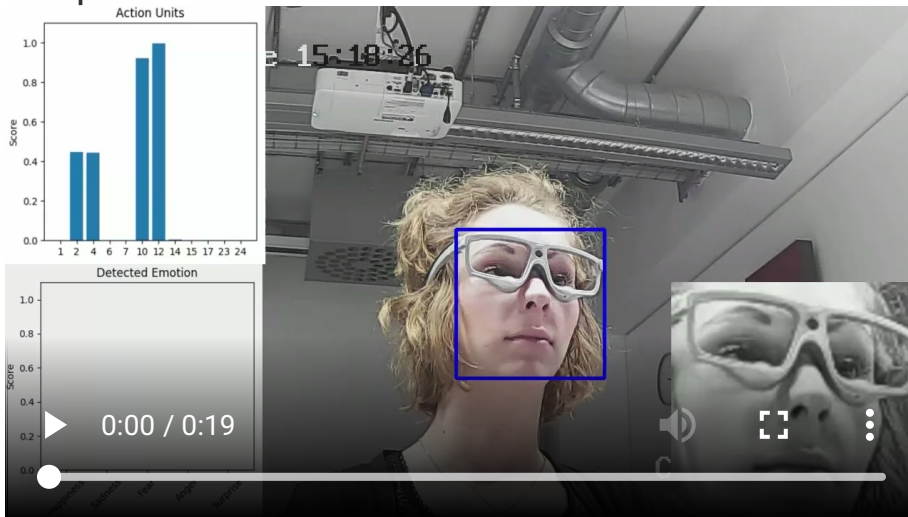
Research: Virtual Reality



Research: Deep Learning

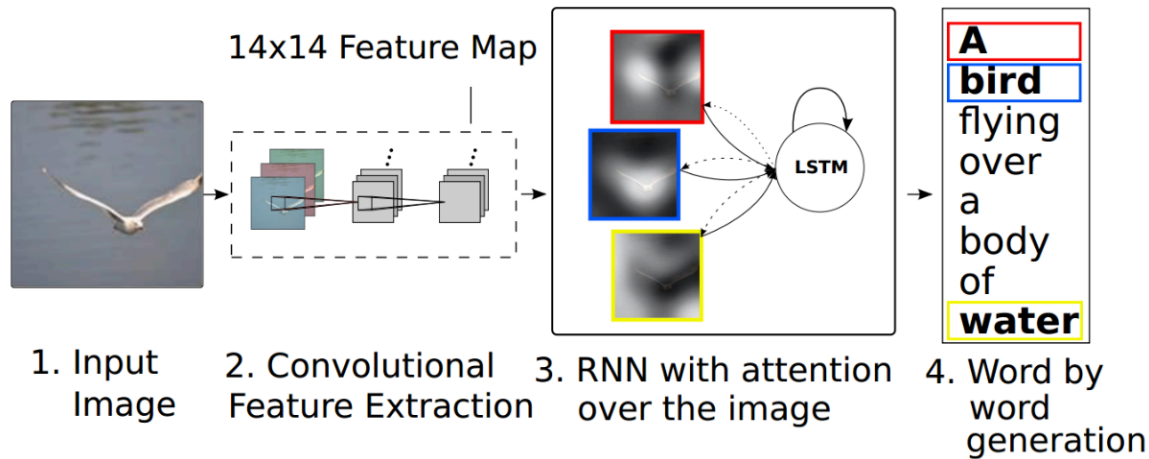


- CNN trained on FACS-annotated datasets to recognize AU activation and emotions in video sequences.



Upper Face Action Units					
AU 1	AU 2	AU 4	AU 5	AU 6	AU 7
Inner Brow Raiser	Outer Brow Raiser	Brow Lowerer	Upper Lid Raiser	Cheek Raiser	Lid Tightener
*AU 41	*AU 42	*AU 43	AU 44	AU 45	AU 46
Lid Droop	Slit	Eyes Closed	Squint	Blink	Wink
Lower Face Action Units					
AU 9	AU 10	AU 11	AU 12	AU 13	AU 14
Nose Wrinkler	Upper Lip Raiser	Nasolabial Deepener	Lip Corner Puller	Cheek Puffer	Dimpler
AU 15	AU 16	AU 17	AU 18	AU 20	AU 22
Lip Corner Depressor	Lower Lip Depressor	Chin Raiser	Lip Puckerer	Lip Stretcher	Lip Funneler
AU 23	AU 24	*AU 25	*AU 26	*AU 27	AU 28
Lip Tightener	Lip Pressor	Lips Part	Jaw Drop	Mouth Stretch	Lip Suck

Research: Scene Understanding



- Scene understanding can be achieved by associating images to sentences.
- A pretrained CNN extracts features from the image, a LSTM learns to generate the corresponding sentence.
- Spatial attention allows to focus on the object associated with the word.

Xu, Ba, Kiros, Cho, Courville, Salakhutdinov, Zemel, Bengio (2015). Show, attend and tell: Neural image caption generation with visual attention. CoRR, arXiv:1502.03044.

Research: Scene Understanding



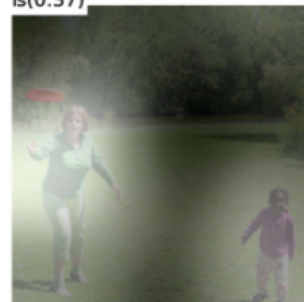
A(0.98)



woman(0.54)



is(0.37)



throwing(0.33)



a(0.28)



frisbee(0.37)



in(0.21)



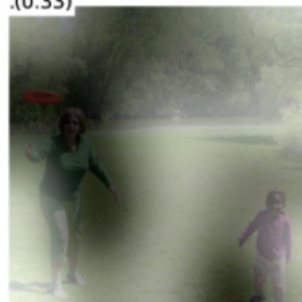
a(0.18)



park(0.35)

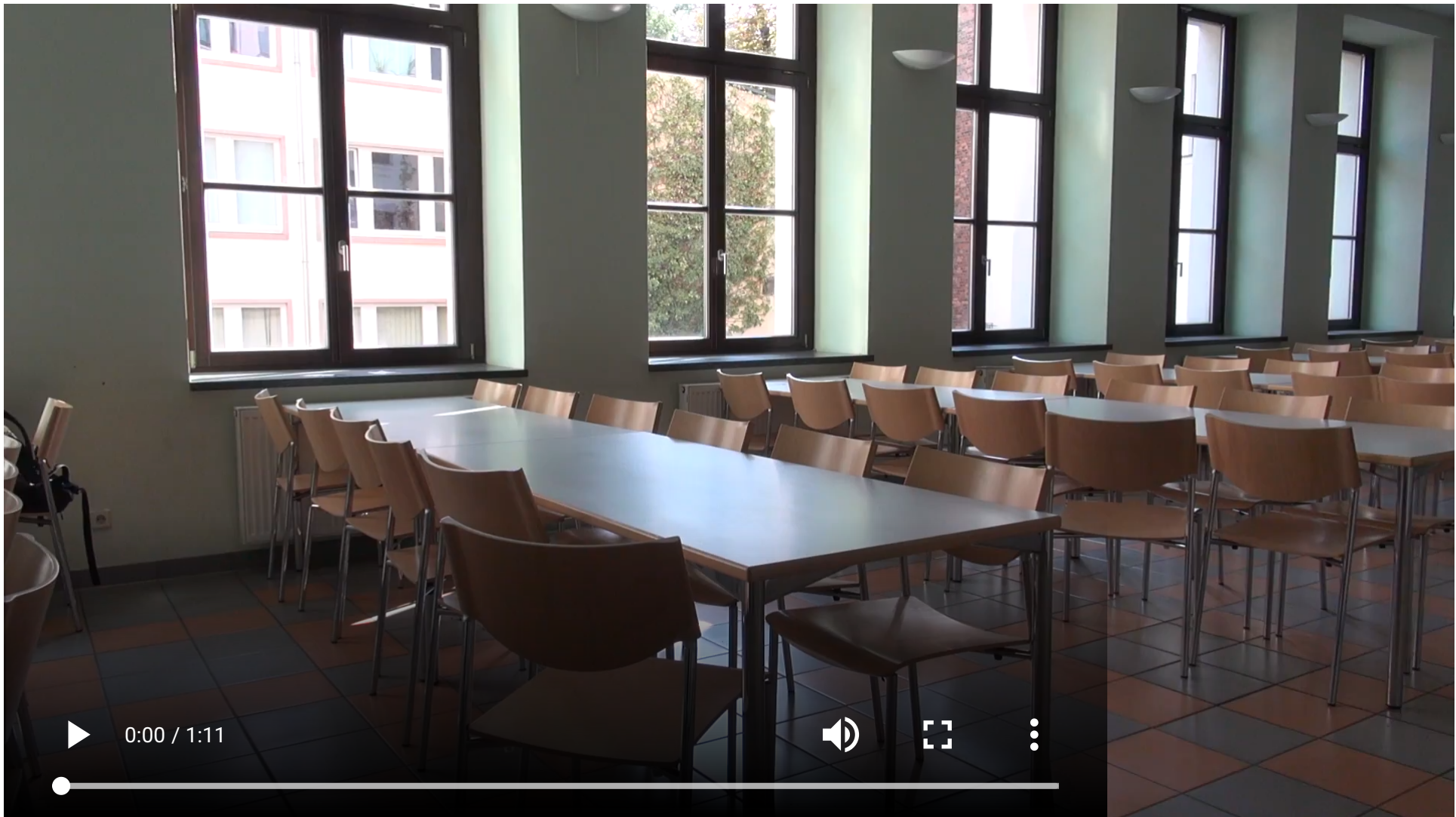


.(0.33)

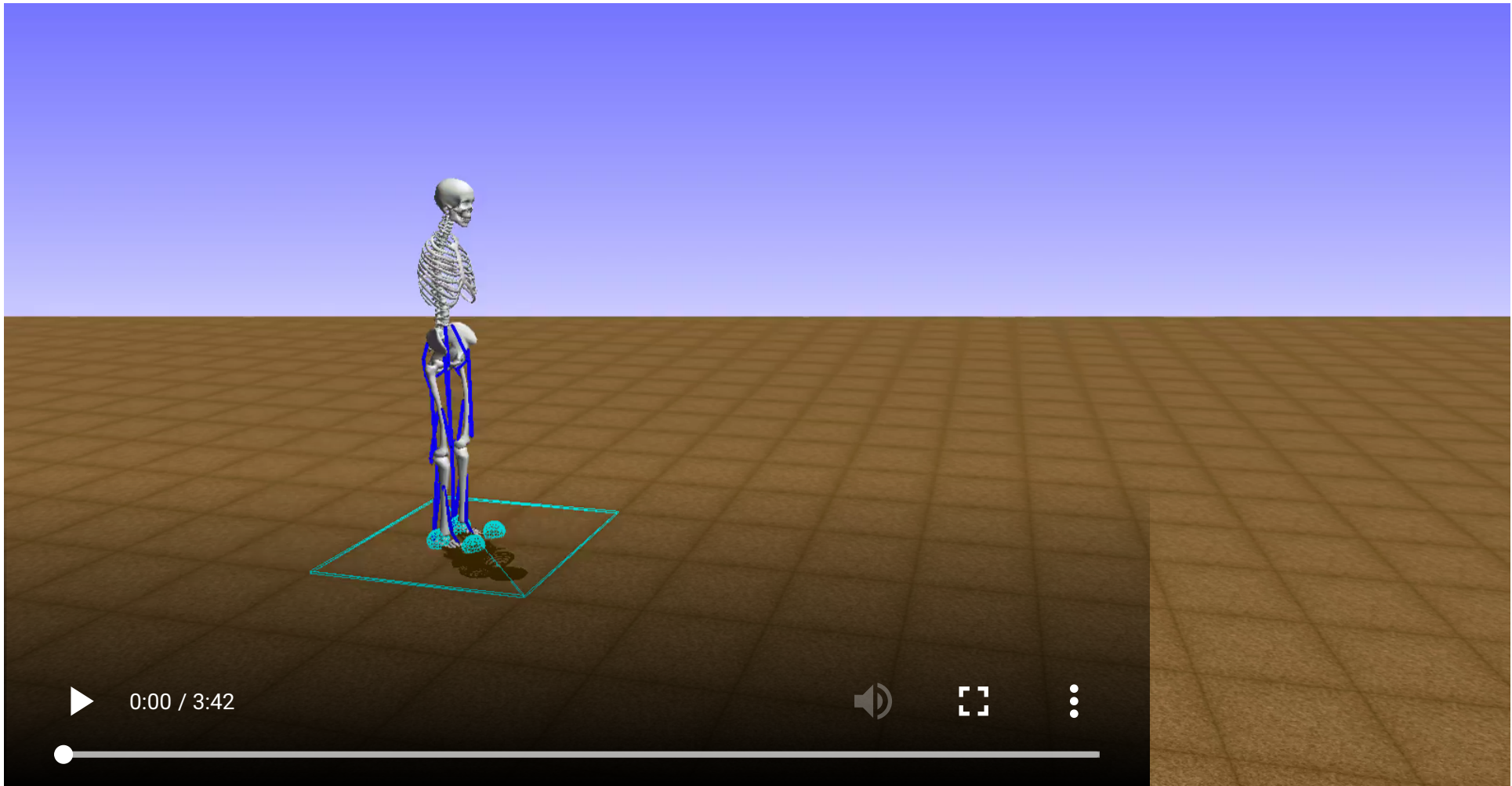


Xu, Ba, Kiros, Cho, Courville, Salakhutdinov, Zemel, Bengio (2015). Show, attend and tell: Neural image caption generation with visual attention. CoRR, arXiv:1502.03044.

Research: Scene Understanding



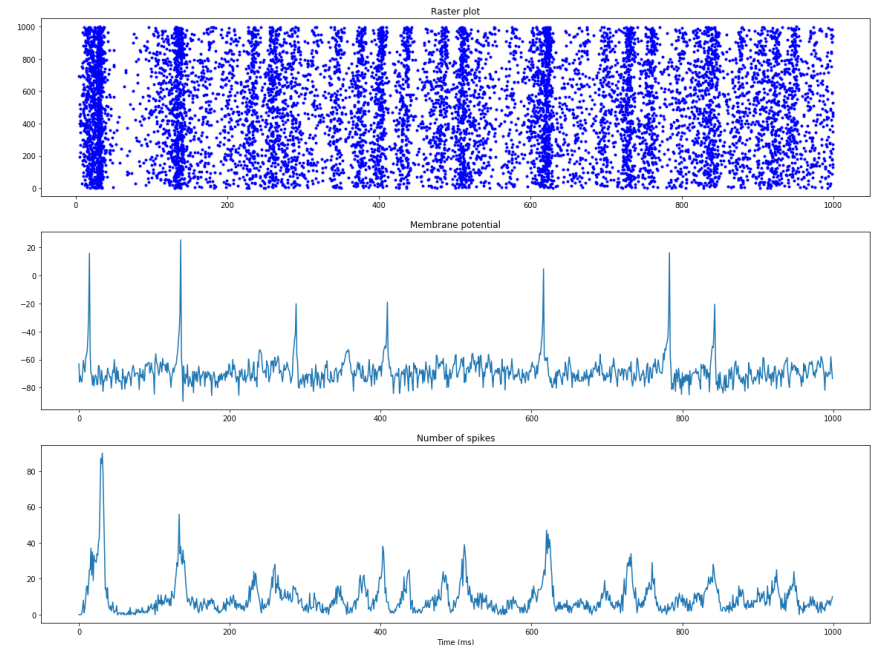
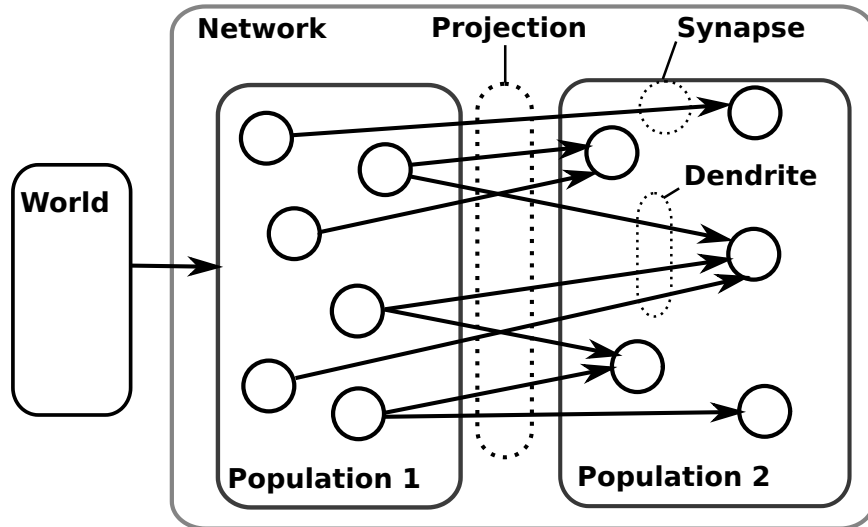
Research: Deep Reinforcement Learning



Frank Witzscher (2017). Scene Understanding on a Humanoid Robotic Platform Using Recurrent Neural Networks. Research internship at the TU Chemnitz.

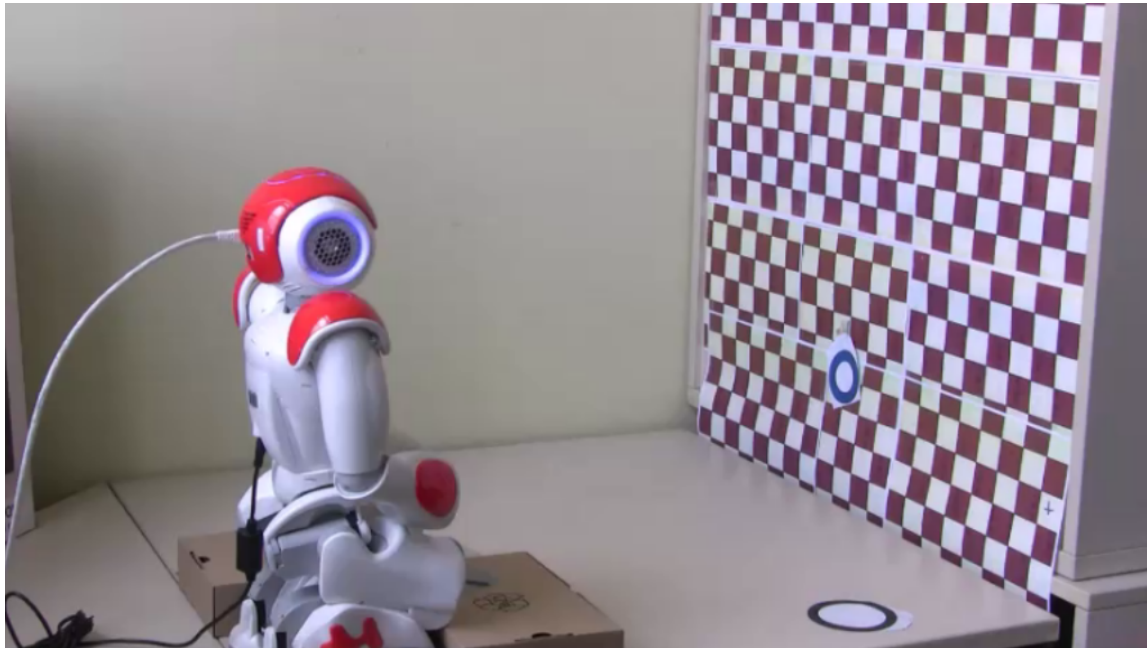
Research: Parallel Computing

- **ANNarchy**: Artificial Neural Networks architect.
- Parallel simulation of biologically realistic neural networks with OpenMP, MPI, CUDA...



Research: Robotics

- Several robots are available in the lab (NAO, iCub...)
- Contact Dr. John Nassour to work with them.



Choice of a topic

- General question: **what is an intelligent system for you?**
- Hint: there is no perfect answer. Be personal and original.
- See the first AI lecture for a discussion on AI:

https://www.tu-chemnitz.de/informatik/KI/edu/ki/ss2019/KI_01_Einleitung.pdf

- Address the question through an example of method / algorithm / application, or through philosophical / cultural aspects.
- The topic **MUST** contain a technical aspect and (at least) conclude on intelligence.
- You have until 03.05 to choose a topic. We can discuss it per email, during my speaking hours (Mondays 13:00 to 14:00) or make an appointment.

Examples (not a list of topics!)

Methods

- Symbolic AI vs. neural networks.
- Can a system be intelligent without learning abilities?
- Deep learning. Why is it so hot nowadays? Does it really lead to intelligent systems (weak/strong AI)? Where are the limits?
- Deep reinforcement learning: application to video games or robotics.

Neuroscience

- Is it possible to build an intelligent system that is not similar to a brain?
- Can neuroscience help AI, AI help neuroscience or both?
- Can an intelligent system be conscious?
- Brain-hacking, augmented humanity / transhumanity.

Examples (not a list of subjects!)

Applications

- Expert systems (medical diagnostic, decision-making)
- Autonomous cars, robotics.
- Personal assistants (chat-bots, robotic companions, e-teaching)
- (Video-) games (AlphaGo, Poker, Starcraft), neural art.

Philosophy / Ethics

- How to recognize that a system is intelligent?
- Fear of AI, singularity: is it reasonable?
- Do we need ethical committees for AI?
- What is needed for robotic companions to be accepted as intelligent (social robotics, uncanny valley)?
- Representation of AI in popular culture (books, movies: Blade Runner, Ghost in the Shell...). What is realistic, what is not?

Forbidden topics

- AI in video games.
 - There is **no** information available about the AI used in video games.
- Overview of AI applications in a particular field
 - AI and the_field_I_studied_before_my_Master_IGS

Last year

Name	Title
Frieda Schulz	KI in der Tourismusbranche
Zane Bieza	Could AI surpass humans in the field of creativity?
Thomas Theumer	Geschichte der KI in Videospiele
Alena Valyalkina	Hate speech, fake news & Co.: using AI to prevent harmful social practices?
Toni Schellner	Artificial Immune Systems
Zlata Neshko	Revolution in der maschinellen Übersetzung? Möglichkeiten und Grenzen.
Yani Wang	Deep reinforcement learning and self-driving cars
Fabius Engel	Kreativen und unterstützenden KIs für Videospiele
Michael Linke	KI-Anwendungen in der Archäologie
Dominik Gorgosch	Die Chatbots Geschichte von ELIZA bis zu heutigen Chatbots
Tingyou Hao	Natural-Language Processing - Overview of Chinese Natural-Language Processing (abgesagt)
Jana Schelle	KI: Automatisierung und Arbeitsmarkt
Yi Mingpeng	Machine learning in computational advertising
Taysha Rebecca Schuller	Kann Künstliche Intelligenz Bewusstsein besitzen?
Zhengking Song	AI in financial risk management

Last year

Name	Title
Kumiko Fujikura	KI und Kunst
Julia Wichmann	BirdCLEF
Tim Schlichenmaier	Dystopie KI - Intelligente Maschinen als Gefahr?
Ben Eric Fischer	Das Gehirn als Computer, der Computer als Gehirn - Künstliche Intelligenz im Spannungsfeld von Philosophie und Wissenschaft
Valentin Forch	The Neural Metaphor of Deep Learning: How Similar are Deep Neural Networks and the Human Brain?
Philipp Liebs	KI in der Juristik
Hendrik Stepina	KI in Sportsimulationen am Beispiel der Madden-Reihe
Nikolai Hartmayer	The Use of Deep Learning Neural Networks in Cancer Detection
Mengen You	KI und Logistik
Song Shiwen	How does Siri work - The current situation and expectation of natural language processing
Anne Münzner	Künstliche Intelligenz und Design. Inwieweit kann künstliche Intelligenz gutes, plausibles Design erkennen und selbst generieren?